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Compsopogon corticrassus, a new species of fresh water red algae (Compsopogonaceae, Rhodophyta)

千原光雄*・中村　武**:

淡水産紅藻の1新種アツカワオオイシソウ

Okamura (1915) described a new species of *Compsopogon*, *C. oishii*, and no other species of this genus has been reported in Japan since that time. For the last several years, we have examined *Compsopogon* in Japan, especially in the Kanto District. We have collected many specimens that have made it possible for us to carry out a detailed analysis of *Compsopogon* in Japan. We recognize three species of the *Compsopogon*-*Compsopogonopsis* complex in Japan. Of these three species, two are already described, *Compsopogon oishii* Okamura and *Compsopogonopsis japonica* Chihara (1976). A third species is apparently a new taxon which is presented here as follow.

Compsopogon corticrassus Chihara et Nakamura, sp. nov.

Thallus filamentosus, cylindricus, 50-80 cm altus, 2-3 mm diametro, atrocyaneus vel olivaceus, multifariam e disco basali multicellulari exoriens, uniseriatus primo, multiseriatus postea, cellula centralis et cortex constans e cellulis tristratis vel quadristratis, profuse ramosus; cellula apicalis thalliformis, 7-15 μm alta, 11-20 μm lata; cellulae strati extimi in parte adulta tetra-, penta-, vel hexangulares aspectu superficiali, 14-36 μm longae, 7-20 μm latae; reproductio asexualis per monosporam; monospora in cellula corticali vel in cellula partis uniseriatae innata per divisionem obliquam vel longitudinalem, spherica, 16-22 μm diametro, microspora vel reproductio sexualis ignota.

Holotypus ad locum Minuma-Yosui, Gyoda-shi, Saitama-ken dictum, m. Nov. d. 20, 1977 lectus, in herb. TNS depositus (AL-35602).

Habitat and occurrence. The plant was common in the areas that we have surveyed. In the Minuma-Yosui River at Gyoda-shi, Saitama-ken, where the type specimen was collected, there were many plants growing on the concrete floor in a riffle where the water moved rapidly. In other localities,

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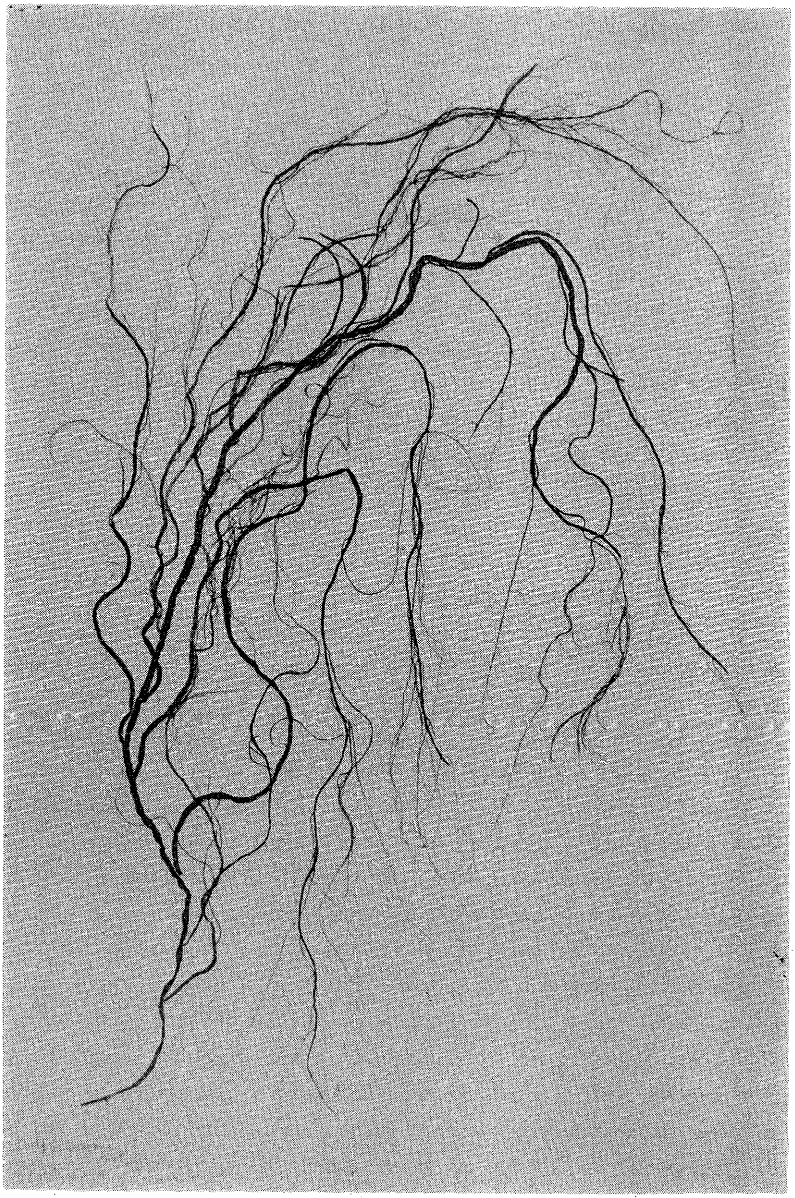


Fig. 1. *Compsopogon corticrassus* Chihara et Nakamura, sp. nov. (holotype in TNS, AL-35602). ×2/5.

including the Yasegawa River at Ota-shi, Gunma-ken, this species grew on large movable rocks, small stones or the leaves of certain aquatic vascular plants, including *Myriophyllum verticillatum* L.

Specimens of *C. corticrassus* could be found at almost any time of the year, but they grew most luxuriantly in summer and autumn when the water temperature was between 15 and 22°C. In early winter when the water temperature was lower than 10°C the plants gradually disappeared, and plants of this species were difficult to find in mid-winter. When substrata were closely examined, however, disc-shaped holdfasts could be found in the winter months, and some short basal parts of filaments survived through entire winter season. In the early spring, when the water temperature warmed to about 12°C many new filaments were found growing from the holdfasts.

Monospores and their germination. Monosporangia are the only reproductive organs formed by *C. corticrassus*. They may be formed at most any time that the plants are actively growing, but most are produced in the summer or early autumn seasons. Monosporangia mother cells are cortical cells which develop a dark, more dense protoplast region that becomes cut off by unequal diagonal cell division, the smaller dark cell becoming the monosporangium (Fig. 2A, B). Neither microspores nor sexual reproductive cells were found at any season of the year.

Discharged monospores are globular, measuring 16–22 μm in diameter, and are filled with dark greenish chloroplasts (Fig. 2C). Germination of monospores is similar to that process as described for *Compsopogonopsis japonica* (Nakamura & Chihara, 1977). The monospores slightly elongates and divides anticlinally to the substrate shortly after it becomes attached. This resulting germling has two cells that are unequal in size (Fig. 2D). The larger of these cells divides obliquely forming a three-celled germling, the cells arranged horizontally (Fig. 2E). The central cell of this germling, which is usually larger than the peripheral cells, divides forming a wall which is almost perpendicular to the longer axis of the germling (Fig. 2F). One of the central cells in the filament is fan-shaped and functions as an initial of an erect filament. The remaining three cells develop into prostrate rhizoids (Fig. 2G, H). The rhizoids later become dichotomously or subdichotomously branched, growing close together and forming a conical holdfast (Fig. 2J). The holdfast measured 170 to 250 μm high and 300 to 400 μm in

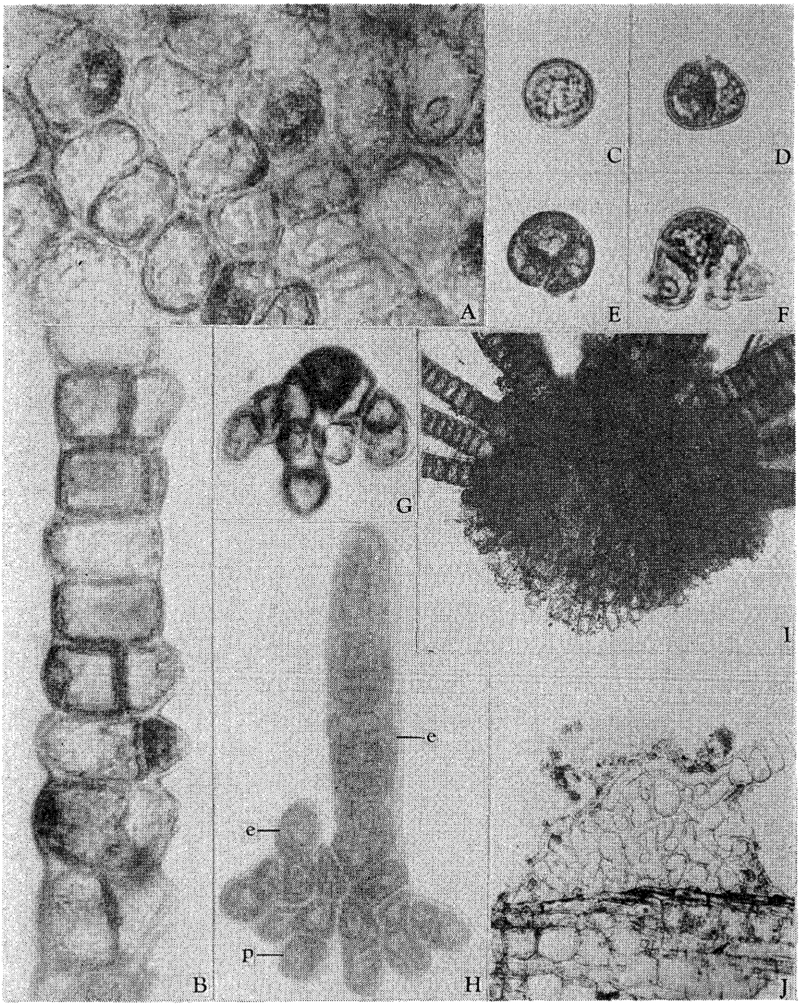
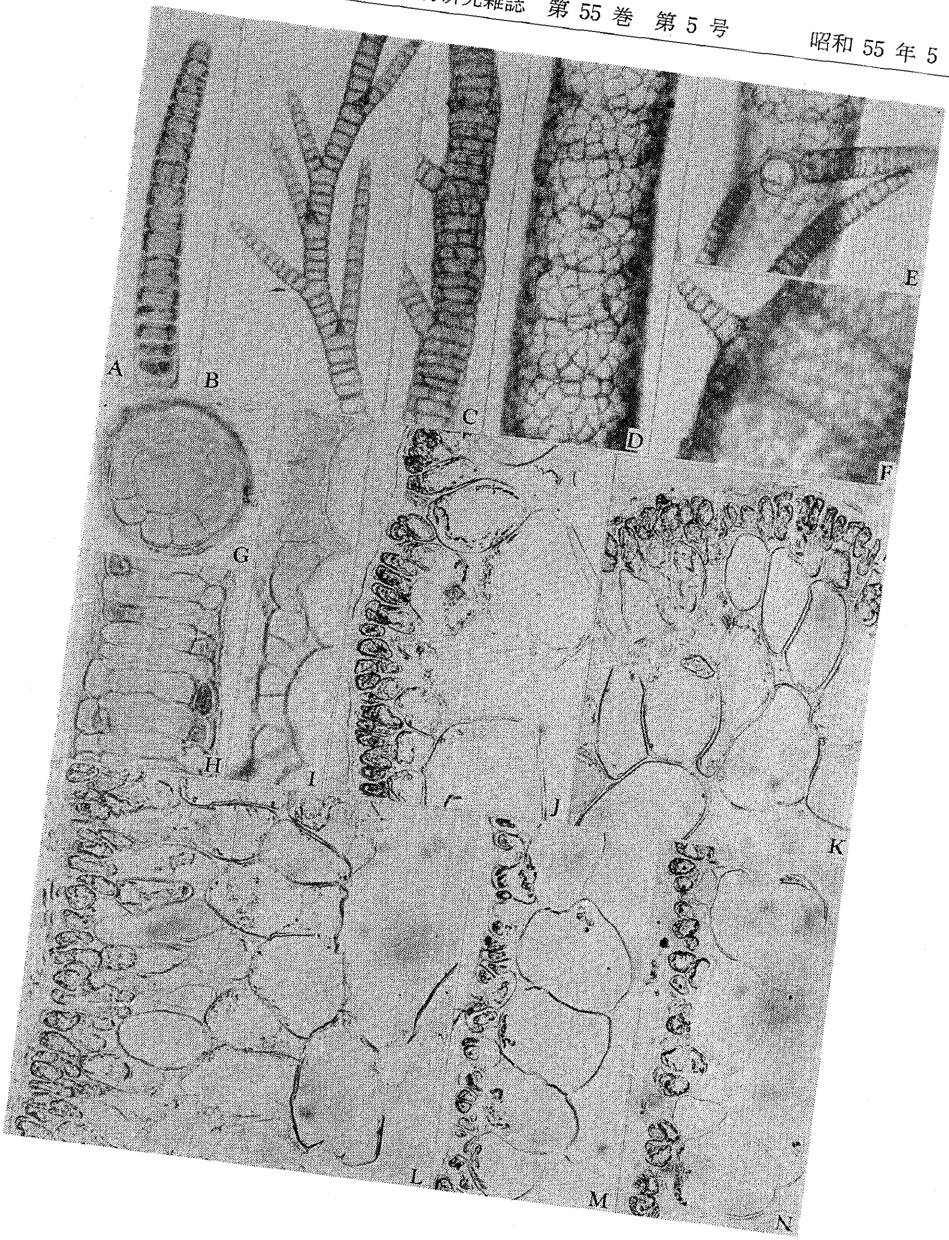


Fig. 2. *Compsopogon corticrassus*. A: Portion of thallus, showing the formation of monosporangia viewed from surface. B: Portion of thallus, showing the formation of monosporangia viewed from lateral. C: Discharged monospore. D-G: Germinating monospores, showing various stages in their early development. H: Germling, showing the formation of two erect filaments (e) from the prostrate disc (p). I: Prostrate disc, bearing many erect filaments. J: Longitudinal section of the prostrate disc, showing its conical shape. A-H ×500, I, J ×125.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diameter in well-developed germlings. The holdfast is capable of producing many erect filaments (Fig. 2I).

Erect filaments are uniseriate at first, cylindrical and consist of disc-shaped cells. In later stages the filaments become multiseriate forming central cells and cortical cells (Fig. 3A-D). The upper part of the filaments remain uniseriate and terminate in a dome-shaped apical cell, the site of most cell divisions in growth of the filaments. Formation of cortical cells (Fig. 3G-I) is the same method as described for other species of *Compsopogon* (Thaxter, 1900; Okamura, 1915; Krishnamurthy, 1962).

Branching of thalli is more or less alternate and branches are issued in all directions around the axis giving the thallus a tufted appearance (Fig. 1). Most branches are formed from uncorticated parts of the thallus (Fig. 3B), but the outermost corticating cells may also secondarily form branches (Fig. 3E, F). Branches formed from uncorticating parts of the thallus become long (indeterminate branches) and occur at from 30 to 90° angles with the axis, whereas branches formed by cortical cells remain much shorter (determinate branches) and occur at about a 90° angles with the axis. Central cells in older parts of the thallus and in old thalli degenerate resulting in the formation of hollow thalli (Fig. 3L). In this characteristic *C. corticrassus* is similar to *C. oishii* (Okamura, 1915). A fully developed thallus of *C. corticrassus* measures 50-80 cm long, 2-3 mm in diameter, and consist of hollow thalli having three or four (rarely five) layers of cortical cells, the entire cortex measuring 300-380 μm thick (Fig. 3J-L). Outer cortical cells are polygonal, having four, five or six sides when viewed from the thallus surface (Fig. 4A) and measure 14-36 μm by 7-20 μm.

Comparison of *C. corticrassus* with related taxa. *Compsopogon oishii* is very much like *C. corticrassus* in general appearance, and the two species, often growing in similar environments, are difficult to distinguish from one another in the field. Examination with the microscope, however, shows that

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Fig. 3. *Compsopogon corticrassus* (A-L) and *C. oishii* (M, N). A-D: Portions of thalli, showing the formation of branches and cortex. E, F: Portions of thalli, showing the formation of secondary branches from the cortical cells. G, H: Portions of thalli, showing central cells surrounded with one-layered cortex; G, transverse section; H, longitudinal section. I-L: Sections of thalli, showing successive stages in the formation of the cortex. Thallus shown in I is furnished with one-layered cells of cortex, whereas those in J-L are with three to five layered cells of cortex. M, N: Longitudinal sections of thalli, showing the cortices composed of two-layered cells. A, G-I ×250, B-F, J-N ×125.

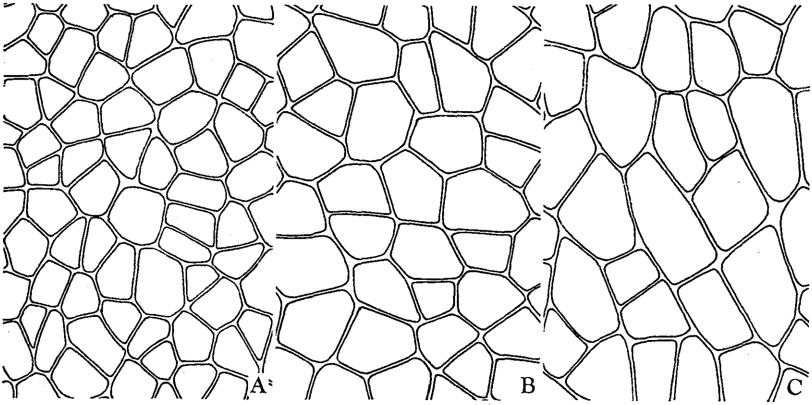

Fig. 4. Outermost cells of thalli in three species of *Compsopogon*, showing their shape and size. A: *C. corticrassus*. B: *C. oishii*. C: *C. coeruleus*. All ×350.

the two species differ in characteristics of the cortex. *C. corticrassus* has three to four (rarely five) layers of cortical cells forming a layer 300 to 380 μm thick, whereas *C. oishii* has a two layered cortex which is 130 to 180 μm thick (Fig. 3M, N; Okamura, 1915). The size of the outermost cortical cells also differs in the two species. *C. corticrassus* has outer cortical cells that measure 14-36 μm by 7-20 μm, whereas the outer cortical cells of *C. oishii* are 16-36 μm by 10-24 μm.

Compsopogon corticrassus resembles *C. coeruleus* (Balbis) Montagne in its general form as well as the structure of the cortex. Kuetzing (1857), Thaxter (1900) and Krishnamurthy (1962) reported that *C. coeruleus* has three to several layers of cells in the cortex. Krishnamurthy (1962) reported that the outermost cortical cells of several specimens of *C. coeruleus*, including the holotype specimen, measured 16-48 μm by 9-20 μm. We had the opportunity of measuring the outer cortical cells of a specimen of *C. coeruleus* identified by Thaxter, deposited in the Herbarium of Tokyo University of Fisheries (by the courtesy of Dr. Kozo Iwamoto), and found them to be 15-51 μm by 11-31 μm, a value similar to that given by Krishnamurthy (1962).

Krishnamurthy (1957, 1962) is of the opinion that spore germination patterns and juvenile stages are useful criteria in determining species of

Compsopogon. Comparing several species of *Compsopogon*, he recognized that there are at least two different types of germination patterns: 1) in which a single erect filament is produced on a prostrate disc, and 2) in which several erect filaments are formed on a prostrate disc. *C. coeruleus* produces only one erect filament from the germinating prostrate disc whereas *C. corticrassus* produces several erect filaments. According to Thaxter (1900) and Krishnamurthy (1962), *C. coeruleus* produces microsporangia in addition to monosporangia. Microsporangia have not been found on *C. corticrassus* despite the fact that we have examined specimens for these sporangia throughout the entire year.

A final comment should be made concerning the formation of hollow thalli as a taxonomic criterion in determining species of *Compsopogon*. Thaxter (1900) figured *C. coeruleus* with a central cell that apparently persisted in the thallus. Okamura (1915) adopted this character as an important one on which *C. oishii*, which is hollow when mature, could be distinguished from *C. coeruleus*. Krishnamurthy (1962) stated that *C. coeruleus* has very mature axes in which the axial cell breaks down forming a hollow thallus. In our examination of Thaxter's specimens of *C. coeruleus* we have not found central cells to be present in fully developed parts of the thallus.

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淡水産紅藻オオイシソウ属の1新種アツカワオオイシソウ *Compsopogon corticrassus* Chihara et Nakamura が埼玉県行田市見沼代用水から得た標品を基準標本として記載された。群馬県太田市の八瀬川及びその付近にも産する。この種は既知種の中で *C. oishii* Okamura 及び *C. coeruleus* (Balbis) Montagne とよく似るが，前者とは皮層部の構成細胞数と厚さ及び表皮細胞の大きさで，後者とは表皮細胞の大きさ，発生の様式及び microsporangia の有無でそれぞれ区別される。なお，岡村 (1915) によって種の識別形質に用いられた髄部構成細胞の残存の有無は上記の3種には適用できないことにも言及した。

○釧路湿原の3湖沼の水草について (神田房行*・角野康郎**・大滝末男***)

Fusayuki Kanda, Yasuro Kadono & Sueo Otaki: On water plants in two lakes and a marsh of the Kushiro Moore, Hokkaido

釧路湿原の中にはシラルトロ湖，塘路湖，達古武沼と呼ばれる3つの大きな淡水の湖沼がある。いずれも釧路湿原の東〜北東に位置し，今から約3千年前にできた海跡湖であると考えられている。これらの湖沼にはいずれもマリモ (*Cladophora sauteri* f. *sauteri*) が生育していることが確認されており，それとともに多くの種類の水草も生育しているが，水草についてはこれまで殆ど調べられていない。著者らは単独に，あるいは共同してこれらの湖沼の水草の調査を行ったのでそれらをまとめてここに記しておきたい。

図1に3湖沼の位置を示した。シラルトロ湖は3湖沼の中で最も北にあり，北緯43°11′，東経144°30′に位置し，面積3.37 km^2，周囲6.5 km，南北に2.6 km，東西に1.4 km の逆L字型の湖である。最大水深は 2.5 mで水は主に北部のシラルトロエトロ川と東部の無名川から流入し，南西部の流出口より釧路川に流出している。この湖には非常に多量のマリモが生育しており，阿寒湖のマリモと全く同品種であることが Sakai (Sci. Pap. Inst. Algol. Res., Fac. Sci., Hokkaido Univ. **5**: 1-104. 1964)，神田 (藻類 **27**: 39-44, **27**: 149-152. 1979) により確認されている。

塘路湖は3湖沼中最大の湖で，北緯43°9′，東経144°30′-35′ に位置し，面積 6.2 km^2，周囲 6.5 km，東西に 5 km，南北に 1 km の東西に細長い湖である。最大水深は